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Digital Technology at Medina College Grade School vis-à-vis Education 4.0 and Technology Acceptance Model

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Abstract

Educational systems have relied on distance learning and digital technologies to an unprecedented degree due to the COVID-19 pandemic. Since the government imposed a restriction on face-to-face classes, schools employed distance education to ensure continuity. This study aims to aid school administrators in making informed decisions on the use of digital technology in the coming school terms by determining the learners' performance, learners'/parents' preference, teachers' preference, teachers' digital literacy, and cost-effectiveness vis-a-vis Education 4.0 and Technology Acceptance Model. The study was conducted at Medina College Grade School, a private non-sectarian institution of learning that offers complete elementary education from Kinder up to Grade 6, adhering to the K-12 Basic Education Curriculum of the Republic of the Philippines. The results suggest that learners perform better during the blended online-modular mode of education; learners and parents favor traditional face-to-face over distance education; teachers highly favor face-to-face mode of education; and teachers with lower levels of digital literacy will likely favor the face-to-face mode of education.

Keywords: educational technology, education 4.0, technology acceptance model, online education, distance learning

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1. Introduction

Numerous educational systems, basic education included, have relied on distance learning and digital technologies to an unprecedented degree due to the 2019 corona virus infectious disease (COVID-19) pandemic (Li et al., 2020). Since the President of the Republic of the Philippines announced in his fifth State of the Nation Address that there would be no face-to-face learning (CNN Philippines, 2020) and the Department of Education stated that schools shall provide and maximize the use of online platforms that do not require physical interactions (DepEd, 2020b), Medina College Grade School deployed the blended online-modular distance education. Consequently, electronic and digital technologies played a major role in the learning and instructional delivery.

Researches and studies on this adaptive approach are still scarce (Li, et al., 2020) and the main problem encountered with the currently employed education modality is whether the electronic or digital technology is impactful to children's learning.

However, the most indispensable technology in education is the teacher itself. Hence, a teacher has to be well-educated and knowledgeable to be able to educate others (Wikramanayake, 2005).

While the currently employed modality is in nature an adaptive approach to the COVID-19 pandemic, one factor of consideration should also be the emergence of the fourth industrial revolution also known as IR4.0 or Industry 4.0.

Industry 4.0 or the fourth industrial revolution is characterized by the advent of smart machines and the internet-of-things (Marr, 2018), where Artificial Intelligence plays a major role in the automation and digitalization of industrial and commercial processes.

Education must also evolve with the industry and the society. Hence, Education 4.0 is a response to the needs of IR4.0, where humans and technology are working together to create novel possibilities in creative and innovative ways (Lase, 2019). Thus Education 4.0 may refer to the use of alternative teaching and learning approaches and/or modalities in education optimized by the use of digital technologies.

Classrooms, in the next five to seven years, will not be limited to the traditional, physical environment. These changes will not be limited to classroom layout but also the mode of delivery (Dunwill, 2016). As of today, there is the advent of massive open online courses also known as MOOCs (see Mora, 2013; Sanchez-Gordon & Luján-Mora, 2014) and virtual classrooms (see Techopedia, 2020) which are not seen in traditional education, but these could evolve in no time with the application of virtual and augmented reality, machine learning, quantum computing, and other developing digital technologies.

However, in the application of digital technologies in education, various factors must be considered. In this study, the underlying principles of the Education 4.0 and Technology Acceptance Model (see Davis, 1989) are treated substantially.

The main purpose of this study is to aid school administrators in making informed decisions on the use of digital technology in the coming school terms, hence, the following variables are highly considered: learners' performance; teachers', learners', and parents' preferences; digital literacy or ICT skills; and cost-effectiveness, while grounded on the concepts of Education 4.0 and Technology Acceptance Model.

Furthermore, this paper aims to provide a thorough discussion on the application of digital technology in basic education to help school administrators decide whether to reduce, retain, or reinforce the use of such technology in the upcoming school terms.

2. Literature Review

COVID-19 has had the most challenging impact on the sector of education all around the world (Tadesse & Muluye, 2020) and forced schools to operate in alternative modes of instructional delivery other than the traditional face-to-face setting. Distance education became the optimum solution to counter the health and safety concerns of the students, teachers, and other stakeholders. The government of the Republic of the Philippines declared that there will be no face-to-face learning at schools (CNN Philippines, 2020) and the Department of Education (2020), as the agency mandated to ensure access to, promote equity in, and improve the quality of basic education, ordered that schools shall provide and maximize the use of online platforms. Consequently, digital technologies played a vital role during these trying times in the education sector. With this rapid shift to digital technologies in education, the researcher considered grounding this study on Education 4.0 and Technology Acceptance Model.

Education 4.0 guarantees that teaching-learning processes will take advantage of the boundless opportunities offered by innovative technology. A study (Alda et al., 2020) recommends that school administrators and faculty members believed that they are prepared enough in terms of their abilities in selecting, curating and integrating digital assets for teaching and learning as they are moreover given capacity-buildings through workshops and seminars related to digital proficiency. Whereas, Montealegre (2019) claimed that the new generation of learners are not just tech-savvy but also technology-dependent. It is, thus, suggested that digital technologies undeniably prove to play an essential role in the delivery of the current and future education system.

Lai (2017) explained in a study that the objective of Davis' (1989) Technology Acceptance Model (TAM) is to clarify the common determinants of computer acceptance that lead to clarifying users' conduct over a wide extent of end-user computing technologies and user populations. The first TAM model included and tried two particular assumptions: Perceived Usefulness (PU) and Perceived Ease of Use (PEU). Perceived Usefulness is characterized as the potential user's subjective inclination that the utilization of a certain system will advance productivity and Perceived Ease of Use refers to the degree to which the potential user expects the target system to be easy (Davis, 1989). The perception of the user towards a system may be impacted by other elements referred to as external variables in TAM. Venkatesh and Bala (2008) devised the TAM3 utilizing the four distinctive types considering the individual differences, system characteristics, social influence, and facilitating conditions which are determinants of perceived usefulness and perceived ease of use. In TAM3 (third version of TAM), the perceived ease of use to perceived usefulness, computer anxiety to perceived ease of use and perceived ease of use to behavioral intention were controlled by experiences.

The understanding of the TAM will aid in the understanding of the perceived digital literacy of teachers and their preferences in the instructional delivery mode for this study. Thus, insights behind the choices of the teachers in utilizing digital technologies in teaching may be impacted by their experiences in the use of technology as well as in their preparatory training activities.

Both the concepts of Education 4.0 and Technology Acceptance Model shall be utilized as instruments to further understand the factors that influence the teachers preferred usage of digital technologies in teaching and delivering instructions to the learners in distance and online education.

3. Methodology

The study was conducted at Medina College Grade School, a private non-sectarian institution of learning that offers complete elementary education from Kinder up to Grade 6, adhering to the K-12 Basic Education Curriculum of the Republic of the Philippines (Official Gazette, n.d.). Situated at National Highway, Barangay Maningcol, Ozamiz City, Misamis Occidental. Maningcol is a suburban barangay that is partly coastal, partly industrial, and mostly agricultural (rice and coconut). Ozamiz City has a population of 6,951 as determined by the Census of Population (Philippine Statistics Authority, 2015). Ozamiz, sometimes spelled Ozamis, is a third-class city in the province of Misamis Occidental with annual regular revenue of 654,453,854.29 Philippine Pesos as of the fiscal year 2016 (Bureau of Local Government Finance, n.d.).

3.1. Research Model/Design

While the primary objective of this study was to determine the learners' performance; teachers', learners', parents' preferences; teachers' digital literacy; and cost-effectiveness grounded on the concepts of Education 4.0 and Technology Acceptance Model, this also aimed to provide insights for the school administrators to decide on whether to reduce, retain, or reinforce the digital technologies installed in the school for the teaching-learning utility. Hence, the researchers opted to employ a correlational retrospective study (Lau, 2017; Von Elm et al., 2014) to compare the learners' performances and preferences in the current school year to the previous. Additionally, the teachers' preference would be correlated with digital literacy. Additionally, further, essence from the Education 4.0 and Technology Acceptance Model concepts would be discussed in depth to serve as a solid foundation for the administrators' decision on the reduction, retainment, and reinforcement of the current technology in the school.

3.2. Data Collecting Tools

Researcher-designed survey questionnaires and interview sheets were utilized with the scholastic documents of the learners, particularly, Learner's Progress Report Card (SF9), Learner's Permanent Record (SF10), Learner Enrollment and Survey Form (DepEd, 2020a), and Student Flexible Learning Survey (Guidance Center, 2020).

3.3. Sampling or Study Group

The main population were the learners in Medina College Grade School from Kinder to Grade 6 levels during the school year 2020-2021. The next set of population involved the teachers in the Grade School department who are all licensed professional teachers (Philippine Teachers Professionalization Act, 1994) aging mid-20s to late 30s with 2 to 4 years of work experience. And lastly, the parents of all the involved learners.

The sample from the learners' population were obtained through availability, which means, only the learners who fulfilled the Learner Enrollment and Survey Form and the Student Flexible Learning Survey and who had had completed the previous school year in the school were included. The teachers, however, were everyone in the population. Finally, the parents' sample were obtained through availability through online surveys and interviews.

3.4. Data Analysis

As a retrospective study, the learners' performance in the current school year was compared to the previous to determine whether or not there could be a significance difference (Lau, 2017). As a correlational study, the researcher assumed that the observations were independent to one another and linear (Aggarwal & Ranganathan, 2016), thus, a correlation analysis was integrated to determine whether the current learners' performance was influenced by the learners' preference and whether the teachers' preference correlate with the level of digital literacy.

3.5. Validity and Reliability

The validity and reliability of the research instruments used in the study were evaluated and approved by the research experts and authority of the Medina College Research Committee. Research ethics were upheld with the utmost consideration. The tools, including the assent and the informed consent, passed the meticulous checkpoints of the school's ethical research board.

3.6. Research Procedures

The researcher gathered the SF9 and SF10 of the learners from school year 2020-2021 and 2019-2020 and compared them to determine significant changes. The compiled Learner Enrollment and Survey Form and the Flexible Learning Survey were also examined to determine the learners' preferred mode of learning. The parents were sent survey questionnaires and interview forms through online communication to gather utilizable data from their population. And lastly, the teachers were given survey forms to determine their preferred mode of instruction and their self-rated level of digital literacy. Ultimately, the researcher conducted data analyses to arrive at a conclusion and open a discussion in relation to the research topic which is to determine the utility of digital technology in Medina College Grade School for the administrators to decide whether to reduce, retain, or reinforce the current technology employed in the school.

4. Results and Discussion

4.1. Learners' Performance

Through ocular evaluation of the learner's grades and academic distinction (Policy Guidelines on Awards and Recognition for the K to 12 Basic Education Program, 2016), by comparing their grades on the same learning areas from their previous year level to the present school year (2020-2021), the data showed a dramatic increase of an average of 4.8 points. While their General Weighted Average (GWA) had shown 3.2 points rise on average.

Moreover, there were also significant changes on the honor's list. Figures 1 and 2 show the percentage of honor students to the total population. The percentage of non-honors dramatically decreased in the latest school year by 22.46% difference to the previous.

Figure 1

Learners' Percentage of Honors during School Year 2019-2020

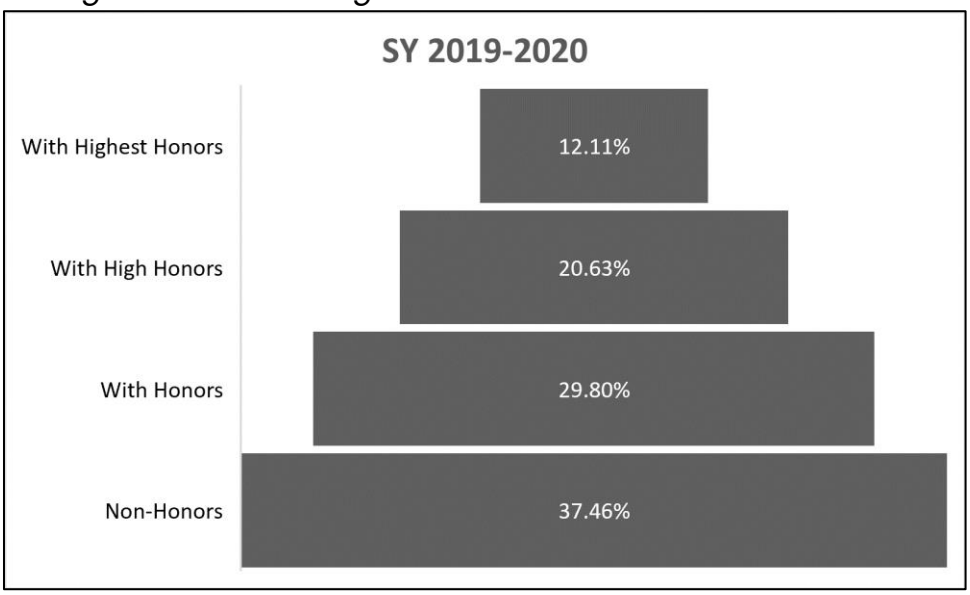
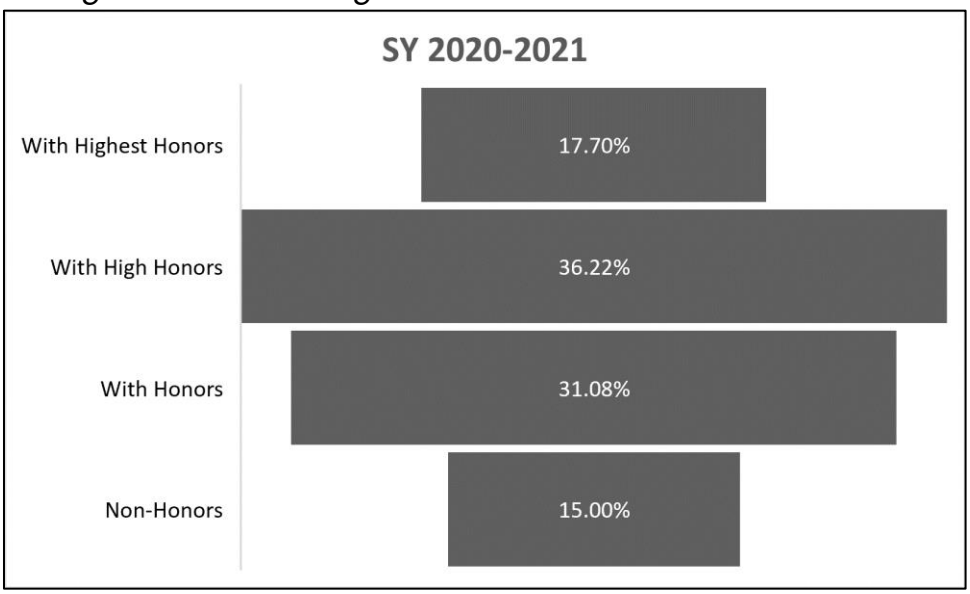


Figure 2

Learners' Percentage of Honors during School Year 2020-2021



Figures 1 and 2 show a significant contrast of the percentages of honors in school years 2019-2020 and 2020-2021. The learners who received an academic distinction as "With Highest Honors" rose to 17.70% in SY2020-2021 from 12.11% in SY2019-2020, "With High Honors" to 36.22% from 20.63%, "With Honors" to 31.08% from 29.80%, while the non-honors fell to 15% from 37.46%.

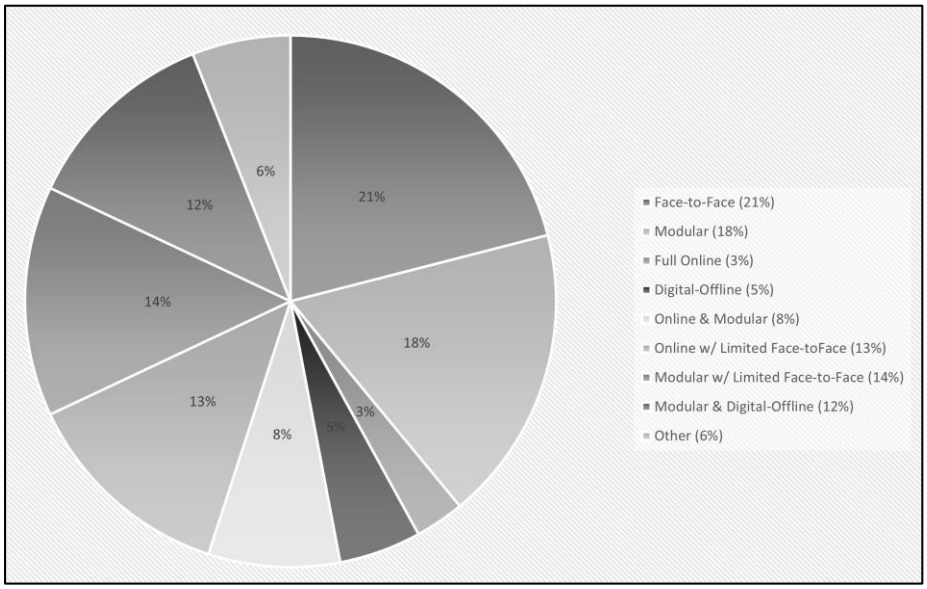
4.2. Learners'/Parents' Preference

Due to the researcher's assumption that parents decide for their children and that the decision on the mode of instructional delivery is a consensus between the parent and the child, it was decided that the data from the learner's enrollment form and the survey questionnaire given to the parents would be used to determine the learner's and parents' both preferences as unanimous.

Parents and learners mostly preferred face-to-face (21%) mode of delivery for educational instructions, followed by the purely modular (18%), and modular with limited face-to-face (14%) as the third preference. Figure 3 shows a comparative illustration of the instructional mode preferences.

Figure 3

Parents' and Learners' Preference in Instructional Mode

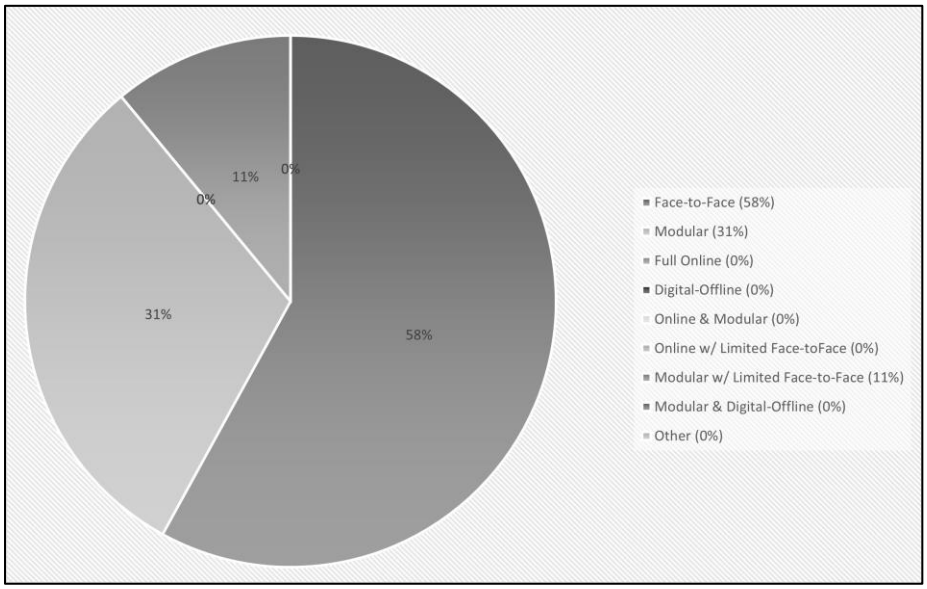


4.3. Teachers' Preference

Face-to-face instruction is also favored by the teachers with 58 percentage of the population. However, there were only three modes selected by the participants. With the earlier mentioned face-to-face (58%), followed by modular (31%), and modular with limited face-to-face (11%), all other modes were not selected and scored zero percentage of the population. This data is illustrated by Figure 4 below.

Figure 4

Teachers' Preference in Instructional Mode

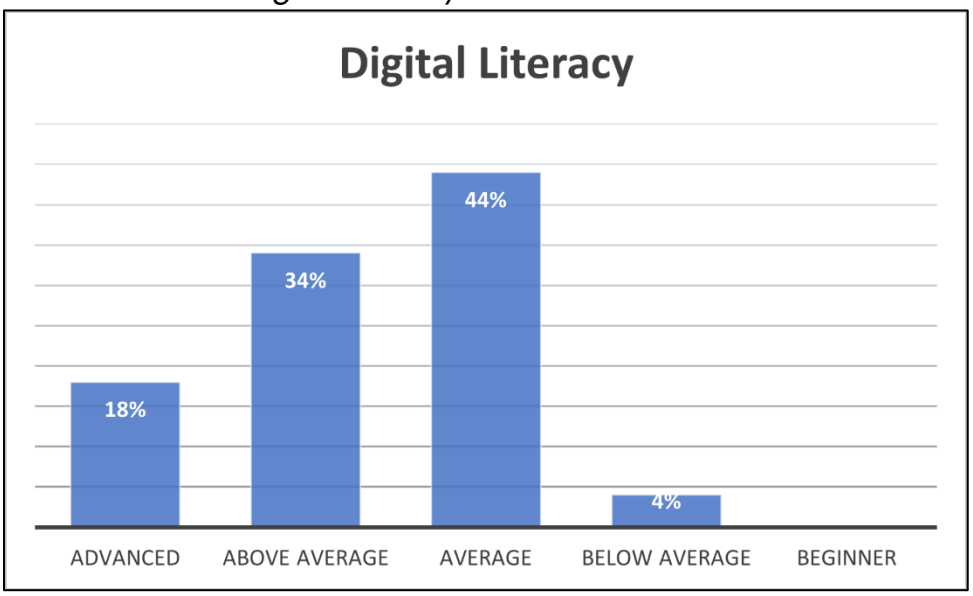


4.4. Teachers' Digital Literacy

The ICT skills and the digital literacy of the teachers were evaluated through their capacity to utilize the internet and various office productivity tools. The teachers' self-rating of their own digital literacy is presented in Figure 5.

Figure 5

Teachers' Level of Self-Rated Digital Literacy



A considerable number of teachers (44%) rated themselves as "average", 34% "above average", 18% "advanced", 4% "below average", and no "beginner" in digital literacy. Where: a "beginner" means that one cannot operate a personal computer at all; a "below average" means that one can perform basic computer operation limited only to encoding and printing word documents, and writing emails; an "average" means one can utilize basic office productivity tools such as encoding and printing word documents, inserting and resizing images, working on spreadsheets but limited knowledge on formulas and functions, creating simple presentations, inserting videos, browsing the internet, and writing emails with attachments; an "above average" means possessing all the abilities of that an average adding video editing and embedding elements to a document or presentation, and insert advance formula and functions on spreadsheets; and an "advanced" means that one possesses all the competencies of an above average while having the ability to write a program, create websites, and troubleshoot common computer problems.

4.5. Cost

The property custodian was consulted to determine the expenses on the school supplies and the cost on utilities, i.e.: power consumption, water, internet and others, in school operations. It was found out that there was no significant change in the expenses for utilities while the school supplies increased by an estimate of 120% compared to the previous school year. However, the increase in expenses for school supplies was compensated as additional charges to the students.

The above-presented data, however, are raw and subject to further data-analysis procedures which will be discussed further in the next section of this paper for conclusion and suggestions.

5. Conclusion and Recommendations

The advancement of digital technology rapidly changes, significantly impacting the different aspects of life, including education (Rizal et al., 2019). As claimed by Luaña (2021) in a research study, the COVID-19 pandemic prodded the sector of education to adapt to the changes and provide quality instructions without sacrificing the health and safety of the learners, teachers, staff, and other stakeholders of the school. While educational institutions employed innovative ways and means to deliver alternative forms of learning other than the traditional face-to-face mode, it must be ensured that the quality, accessibility, relevance, and continuity of education are optimum.

The results of this study offer informative implications of the learners' academic performance; learners', parents'; and teachers' preferred mode of instruction delivery; levels of the teachers' digital literacy; and school operation cost. This will help provide insights for an informed decision-making and policies for school administrators whether to reduce, retain, or reinforce the use of digital technologies in the school.

5.1. Conclusion

The results suggest that learners were performing better than the previous school year. This implies that the implementation of the blended online-modular distance education improves the learners' performance as evinced by the increase in GWA and number of academic honor rolls.

While this study could not ensure the effectivity of the learning modules, Luaña (2020) contended that parents answer the activities and assessments in their children's module. This could mean that the learners GWA and academic recognition are not truly reflective of the children's learning. However, giving the benefit of the doubt, evidence shows that the learners perform better during the blended online-modular mode of education.

As clarified, it is assumed that the learners' and parents' preference were consensual and unanimous, thus, it is considered one set of data for this aspect of the study. The data suggest that learners and parents highly favor the traditional, face-to-face mode of education. This result could be attributed to the additional cost incurred by the school to their account, which was confirmed by the parents' responses on the online interview form asking for the reasons of their selected preference. This is in congruence with the claim of Lase et al. (2020) that learners prefer face-to-face modality of learning over distance learning.

Teachers highly favor face-to-face mode of education, too, as the data in this study further presented. This is consistent with the claims in a press release reporting a study conducted by UNICEF (Knight, 2021) and a report by Bauer-Wolf (2019). Reports contended that teachers prefer full face-to-face classes and are amenable with blended face-to-face learning. This can be explained by the teachers' inclination on favoring on the ban of gadgets in learning, especially in the classroom, since such technology could be a source of distraction and decrease of engagement of students (Bauer-Wolf, 2019).

However, in this study, the researcher also aimed to determine if there is a correlation between the teachers' preference and their self-rated level of digital literacy. The two variables were statistically analyzed to measure the strength of their relationship and whether the relation is significant or not (Dahiru, 2008). It has been found out that there is a negative correlation between the teachers' preference in face-to-face mode versus the teachers' level of digital literacy. Hence, teachers with low level of digital literacy will highly favor face-to-face. Additionally, the results obtained a p-value = 0.32, which means that the likelihood is fairly significant. Albeit, it seems that teachers with lower level of digital literacy will likely favor face-to-face mode of education.

5.2. Limitations

This study, while providing significant insights into the use of digital technology at Medina College Grade School vis-à-vis Education 4.0 and the Technology Acceptance Model, is subject to several limitations presented in the succeeding sections.

5.2.1. Scope of Population

The sample population was limited to Medina College Grade School, a single institution. This limits the generalizability of the findings to other schools or educational contexts. The results may not reflect the experiences of schools with different technological infrastructures or teaching strategies.

5.2.2. Timeframe

The study's retrospective design only compares data from two consecutive school years, 2019-2020 and 2020-2021. A longer study period might reveal more comprehensive trends and patterns related to the integration of digital technology in education.

5.2.3. Self-reported Data

Teachers' digital literacy and preferences, as well as parents' and learners' preferences, were gathered through self-reported surveys and interviews. Self-reporting may introduce bias, as participants may overestimate or underestimate their capabilities, preferences, or performance.

5.2.4. External Variables

The study considers learners' performance and preferences, and teachers' digital literacy, but does not account for external factors such as the home learning environment, internet connectivity, or access to devices. These variables can significantly impact both learners' performance and the perceived ease of use of digital technologies.

5.2.5. Technology Variability

The study does not explore the variability in the types of digital technologies used across different subjects or teaching methods. Different digital tools may have varying levels of effectiveness depending on their application, which may affect the conclusions drawn from this study.

5.2.6. Cost-effectiveness

While cost-effectiveness was considered, the study does not delve deeply into the long-term financial sustainability of implementing Education 4.0 technologies, especially for

schools in rural or underfunded areas like Medina College, which could face different budgetary constraints in the future.

5.2.7. Limited Teacher Experience

The teachers included in the study had between 2 to 4 years of experience. The limited range of teaching experience might influence the results, as more experienced educators may have different perspectives on the use of digital technology compared to their less experienced counterparts.

5.2.8. Technological Evolution

The study was conducted during a period of rapid technological change, accelerated by the COVID-19 pandemic. As new technologies and educational practices emerge, the findings may quickly become outdated, limiting the relevance of this study to future educational contexts.

5.3. Recommendations

By acknowledging the limitations in the previous section, future research can address these gaps to provide a more comprehensive understanding of the role of digital technology in education, especially within the context of Education 4.0 and TAM.

Based on the data and insights obtained from this research undertaking, the researcher strongly suggests to retain or reinforce the utilities for digital technologies in the school. The currently deployed blended online-modular education proved to be effective in alternative delivery of education as the learners' performance improved. The current restriction on face-to-face classes, however, is assumed to be temporary during the onset of the pandemic, the future of the education landscape will be overwhelmed with future innovations and advanced technologies as proposed by Education 4.0. Even when the classes will have to be resumed eventually, the dependence of the teachers and learners on digital technologies.

Even though the study presented more than double increase in the expenses for school supplies, this could be attributed only to the reproduction of the learning modules, since blended mode is adapted by the school. It is assumed that when the face-to-face mode is permitted to resume, the need for the school supplies required by the module production will likely to decrease, if not obliterated. However, the need to maintain and improve the present digital technology infrastructure will persist.

Whether the currently trending distance education that is reliant on digital technologies or the traditional face-to-face in the past will be the future of education system, the decision to retain or reinforce the presently employed digital infrastructure is no longer in question.

This study was conducted at Medina College Grade School, Ozamiz City, involving learners from Kinder to Grade 6 levels, licensed professional teachers in elementary education, and low- to middle-income household parents. The breadth of the scope of this study entails wide and various limitations. Thus, it is proposed to conduct further study on different school settings and a larger number of participants.

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Conflict of Interest

The author discloses no conflict of interest for the publication of this article.

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